

## WHAT IS CLAIMED IS:

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1                    1.        An electric toothbrush comprising:  
 2                    a brush head assembly;  
 3                    a housing;  
 4                    a frame enclosed by the housing;  
 5                    a power supply contained within the housing;  
 6                    an electric coil and core that is secured relative to the frame and  
 7 electrically connected to the power supply through a control circuit that creates an  
 8 alternating flow of current in the coil;  
 9                    an elongated driveshaft having a distal end that is connected to the  
 10 brush head assembly and an internal end that is disposed within the housing;  
 11                    a torsion bar is secured to the frame at a first end;  
 12                    <sup>clamped</sup> an armature having first and second ends, the armature is connected  
 13 to one of the torsion bar or the driveshaft;  
 14                    at least one magnet arranged on the armature, the magnet being  
 15 aligned relative to a central axis of the driveshaft, the magnet being located at a  
 16 radially spaced location relative to the central axis of the shaft, wherein the  
 17 alternating flow of current in the electric coil at a predetermined frequency causes  
 18 the first and second ends of the armature to be alternately attracted to the coil and  
 19 core causing the torsion bar to twist and causing the driveshaft to oscillate in an  
 20 oscillatory rotary motion.

1                    2.        The electric toothbrush of claim 1 wherein the frame is a one  
 2 piece die casting to which the coil, torsion bar and a bearing that journals the  
 3 internal end of the driveshaft are secured.

1                    3.        The electric toothbrush of claim 1 wherein the torsion bar is  
 2 clamped by an anchoring plate to the frame at the first end.

1                    4.        The electric toothbrush of claim 1 wherein a bearing journals  
 2 the internal end of the elongated shaft for oscillating rotary movement and inhibits  
 3 translational movement.

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1                   5.     The electric toothbrush of claim 1 wherein the brush head  
2 assembly has a driven shaft that is detachable from the driveshaft.

1                   6.     The electric toothbrush of claim 5 wherein the brush head  
2 assembly may be detached from the driveshaft without opening the housing and  
3 without effecting the coil and magnets.

1                   7.     The electric toothbrush of claim 1 wherein said at least one  
2 magnet arranged on the armature includes a first magnet and a second magnet, and  
3 wherein the torsion bar is secured to the armature between the first and second  
4 magnets and the driveshaft is connected at the internal end thereof to the armature.

1                   8.     The electric toothbrush of claim 1 wherein the coil is  
2 connected to a E-shaped coil armature.

1                   9.     The electric toothbrush of claim 1 wherein said at least one  
2 magnet arranged on the armature includes a first magnet and the armature  
3 supporting the first and second magnets on a flat plate portion on which the first and  
4 second magnets are disposed and a flange extending perpendicularly relative to the  
5 flat plate portion, wherein the driveshaft is secured to the flange.

1                   10.    The electric toothbrush of claim 1 further comprising a  
2 charging coil contained within the housing for recharging the power supply  
3 contained in the housing.

1                   11.    The electric toothbrush of claim 10 in combination with a  
2 charging base, wherein a charging circuit is provided to charge the power supply,  
3 and wherein placing the electric toothbrush in the base ends an operating cycle.

1                   12.    The electric toothbrush of claim 1 further comprising a single  
2 control switch that may be pressed multiple times to select one of a plurality of  
3 operational speeds.

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1 13. The electric toothbrush of claim 1 further comprising a  
2 plurality of LEDs that indicate at which speed the brush is operating.

1 14. The electric toothbrush of claim 1 wherein the brush head  
2 assembly includes a plurality of bristles having bristle tips that oscillate with the  
3 elongated shaft, the bristle tips moving at a speed substantially less than 1.5 meters  
4 per second.

1 15. The electric toothbrush of claim 1 wherein oscillation of the  
2 brush head assembly creates acoustic pressure of substantially less than 1.5kPa.

1 16. The electric toothbrush of claim 1 wherein oscillation of the  
2 brush head assembly creates shear stress of substantially less than 50 Pa on bacteria  
3 on the teeth in interdental and gingival areas .

1 17. An electric toothbrush comprising:  
2 a handle enclosing an electric coil that oscillates a driveshaft about  
3 a longitudinal axis, the drive shaft is fixedly secured to the handle at a first end by  
4 an elongated torsion bar that is coaxial with the driveshaft, the driveshaft is received  
5 in a bearing disposed in the handle at a second end of the driveshaft that oscillates  
6 in an oscillatory rotary motion relative to the handle; and  
7 a brush head assembly removably secured to the handle, the brush  
8 head assembly having a driven shaft that is operatively secured to the second end  
9 of the driveshaft to oscillate with the driveshaft.

-no magnet

1 18. The electric toothbrush of claim 17 further comprising a frame  
2 that is formed as a one piece die casting to which the coil, torsion bar and a bearing  
3 that journals the internal end of the driveshaft are secured. (2)

1 19. The electric toothbrush of claim 18 wherein the torsion bar  
2 is clamped by an anchoring plate to the frame at the first end. (3)

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1                    20.    The electric toothbrush of claim 17 wherein a bearing journals  
2    the internal end of the elongated shaft for oscillating rotary movement and inhibits  
3    translational movement.    (4)

1                    21.    The electric toothbrush of claim 17 wherein the brush head  
2    assembly has a driven shaft that is detachable from the driveshaft.    (5)

1                    22.    The electric toothbrush of claim 17 wherein the brush head  
2    assembly may be detached from the driveshaft without opening the housing and  
3    without effecting the coil, core, and magnets.    (~)

1                    23.    The electric toothbrush of claim 17 further comprising a  
2    torsion bar that is secured to an armature between a first magnet and a second  
3    magnet and the driveshaft is connected at an internal end thereof to the armature.

1                    24.    The electric toothbrush of claim 17 wherein the coil is  
2    connected to an E-shaped coil armature.

1                    25.    The electric toothbrush of claim 17 further comprising an  
2    armature supporting the first and second magnets, the armature having a flat plate  
3    portion on which the first and second magnets are secured and a flange extending  
4    perpendicularly relative to the flat plate portion, wherein the driveshaft is secured  
5    to the flange.

1                    26.    The electric toothbrush of claim 17 further comprising a  
2    charging coil contained within the housing for recharging the batteries contained in  
3    the housing.

1                    27.    The electric toothbrush of claim 26 in combination with a  
2    charging base, wherein a charging circuit is provided to charge the batteries, and  
3    wherein placing the electric toothbrush in the base ends an operating cycle.

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1                   28.     The electric toothbrush of claim 17 further comprising a single  
2 control switch that may be pressed multiple times to select one of a plurality of  
3 operational speeds.

1                   29.     The electric toothbrush of claim 17 further comprising a  
2 plurality of LEDs that indicate the speed at which the brush is operating.

1                   30.     The electric toothbrush of claim 17 wherein the brush head  
2 assembly includes a plurality of bristles having bristle tips that oscillate with the  
3 elongated shaft, the bristle tips moving at less than 1.4 meters per second.

1                   31.     The electric toothbrush of claim 17 wherein oscillation of the  
2 brush head assembly creates acoustic pressure of substantially less than 1.5kPa.

1                   32.     The electric toothbrush of claim 17 wherein oscillation of the  
2 brush head assembly creates shear stress of substantially less than 50 Pa on bacteria  
3 on the teeth in interdental and gingival areas.

1                   33.     An electric toothbrush comprising:  
2 a brush head assembly;  
3 a housing;  
4 a frame enclosed by the housing;  
5 a power supply contained within the housing;  
6 an electric coil fixedly mounted relative to the frame and electrically  
7 connected to the power supply through a control circuit that creates an alternating  
8 flow of current in the coil;  
9 an elongated driveshaft/torsion bar <sup>obj.?</sup> having a distal end that is  
10 connected to the brush head assembly and an internal end that is secured to the  
11 frame at an inner end;  
12 an armature connected to an intermediate portion of the  
13 driveshaft/torsion bar; and  
14 at least one magnet arranged on the armature having first and second  
15 ends, the magnet being aligned relative to a central axis of the driveshaft/torsion

16 bar, the magnet being located at radially spaced location relative to the central axis,  
17 wherein the alternating flow of current in the electric coil at a predetermined  
18 frequency causes the first and second ends of the armature to be alternately attracted  
19 to the coil and core causing the driveshaft/torsion bar to oscillate in an oscillatory  
20 rotary motion.

1 34. A removable brush head assembly and electric toothbrush  
2 body, in combination, comprising:  
3 a brush head;  
4 a plurality of bristles molded into the brush head;  
5 an elongated brush head body having an attachment end and a brush  
6 head end;  
7 a driven shaft extending longitudinally through the brush head body,  
8 the driven shaft having a distal end embedded in the brush head;  
9 a driven shaft holder receiving the driven shaft with the distal end  
10 extending outwardly from the driven shaft holder, the driven shaft holder being  
11 received in the brush head body, wherein the driven shaft drives the brush head to  
12 oscillate in an oscillatory rotary motion relative to the driveshaft holder and brush  
13 head body; and  
14 the attachment end of the brush head body having a first locking  
15 element and the toothbrush body having a second locking element that cooperates  
16 with the first locking element to detachably retain the brush head body on the  
17 toothbrush body.

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